INTERNATIONAL MIGRATION REVIEW

Ethnic Segregation, Tipping Behavior, and Native Residential Mobility[1]

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We study tipping behavior in residential mobility of the native population in Sweden between 1990 and 2007. Using regression discontinuity methods, we find that the native population growth in a neighborhood discontinuously drops once the share of non-European immigrants exceeds the identified tipping point. Native tipping behavior can be ascribed to both native flight and native avoidance. Natives with a high level of educational attainment and the highest labor earnings are more likely to move from neighborhoods that have tipped. We conclude that tipping behavior is likely to be associated with ethnic as well as to socio-economic segregation in Sweden.

INTRODUCTION

The question of immigrants' location choices in the host country has received the attention of researchers in the past few decades (*e.g.* Bartel 1989; Borjas 1999; Åslund 2005). The United States and several countries in Europe have experienced a large inflow of immigrants into certain geographical areas and cities leading to ethnic segregation. The driving forces behind this ethnic segregation as well as the presence of ethnic enclaves and their importance for the economic success among

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the foreign born have been widely studied (*e.g.* Cutler, Glaeser, and Vigdor 1999; Edin, Fredriksson, and Åslund 2003; Bayer, McMillan, and Rueben 2004; Saiz and Wachter 2011; Patacchini and Zenou 2012). Researchers have long been interested in the dynamics of segregation and have argued that the majority's preferences for neighborhoods with a low minority share may be an important factor. Schelling (1971) showed that social interaction in preferences may lead to extreme segregation. If the minority share of a neighborhood reaches a critical level, *a tipping point*, the neighborhood experiences an outflow of majority residents, leading to full segregation. Schelling showed that fully segregated neighborhoods are likely to be the outcome, even when the majority's preferences for living in neighborhoods with a low minority share are weak. In the Schelling model, integrated neighborhoods are unstable, and even small changes in the neighborhood composition lead to an all-majority or all-minority neighborhood (Card, Mas, and Rothstein 2008a). Card, Mas, and Rothstein (2008b) formalized a model in which an ethnically mixed neighborhood can remain stable as long as the minority share remains below the tipping point. However, when the minority share in the neighborhood exceeds this tipping point, all-majority residents will leave the neighborhood, resulting in full segregation. When applying their model to US data, Card, Mas, and Rothstein (2008b) documented tipping-like behavior among whites in several US cities. Further, they found that white tipping behavior varied among cities with different attitudes towards ethnic minorities.

In European cities, specific ethnic groups very seldom dominate certain residential neighborhoods as in the United States. In contrast, residential segregation is characterized by a spatial separation between the majority population and a mix of minority groups (*e.g.* Johnston, Forrest, and Poulsen 2002). The different pattern of ethnic residential segregation observed in Europe makes it interesting to explore whether tipping behavior exists in European countries. This paper examines tipping behavior among natives in Sweden; more specifically, we examine native residential mobility and its possible contribution to ethnic segregation in Sweden during the 1990s and between 2000 and 2007. The results have implications for research concerning the relationship between ethnic residential patterns and labor market outcomes as well as social outcomes such as school achievement for research for the Swedish case, *see* for example, Nordström Skans and Åslund 2010; Åslund et al. 2011. We use register data from 1990, 2000, and 2007 and apply the method developed by Card, Mas, and Rothstein (2008b) to identify municipality-specific tipping points and to study tipping behavior among natives in Sweden's 12 largest municipalities.

Sweden is a suitable testing ground for analyzing tipping behavior for several reasons. Firstly, Sweden has a long history of immigration. In 2013, about 14 percent of Sweden's total population was foreign born. Secondly, the character of immigration to Sweden has changed. Even if the majority of the foreign-born population in Sweden still originates in European countries, the great majority of the immigrants coming to Sweden today are refugees and "tied movers" from Asia, Africa, and the Middle East. Apprehensions about the fact that these immigrants should prefer to settle in neighborhoods with a large share of immigrants from their own group have often been expressed. As in other European countries, there is a residential divide between natives and almost all immigrant groups, but especially between European and non-European immigrants. Thirdly, discrimination against ethnic groups in the Swedish housing market is well documented (Ahmed and Hammarstedt 2008; Ahmed, Andersson, and Hammarstedt 2010). Thus, we have good reasons to believe that natives tend to avoid or move out of areas with a large share of inhabitants from certain ethnic groups.

Apart from studying tipping behavior in the European context, we make two important contributions to previous literature. First, our data allows us to explore the extent to which the drop in the native population can be attributed to an increased out-migration rate or a decreased in-migration rate of natives. In US literature, this is termed "white flight" and "white avoidance" (*e.g.* Goering 1978; Frey 1979; Marshall 1979; Clark 1992; Quillian 2002). The importance of native flight and native avoidance to the increased immigrant concentration in Sweden has been addressed in a descriptive study by Bråmå (2006). She finds that although both native flight and native avoidance can be attributed to the increased immigrant concentration, native avoidance appears to be the main driving force.

Secondly, our data makes it possible to study whether tipping behavior is associated with socio-economic segregation. The access to individual data enables us to explore possible selection in the outflow of natives from neighborhoods that have experienced tipping. If native migration is selective in the sense that individuals with, for example, high labor earnings are more likely to move out of such areas, tipping behavior may also be associated with socio-economic segregation. More specifically, we explore whether tipping behavior is associated with segregation in terms of educational attainment and labor earnings.

Our empirical analyses proceed as follows: We define immigrants as foreign-born individuals and divide them into immigrants originating from European countries and immigrants originating from non-European countries. Individuals who were born in Sweden are defined as natives. The reason we make this distinction is that we want to explore whether natives respond differently to an increased inflow of European and non-European immigrants, respectively, to their neighborhood. We have reason to believe that this is the case, as previous research have documented discrimination against non-European immigrants on the Swedish labor and housing market as well as differences in labor market outcomes between non-European and European immigrants (Hammarstedt 2003; Carlsson and Rooth 2007; Hammarstedt and Shukur 2007; Ahmed and Hammarstedt 2008; Ahmed, Andersson, and Hammarstedt 2010). We apply the method introduced by Card, Mas, and Rothstein (2008b) to identify municipality-specific tipping points related to these two groups of immigrants. We then use regression discontinuity methods to quantify the effect of the tipping points on growth in the native population. Next, we explore the extent to which the (possible) decrease in native population growth is driven by native flight (*i.e.* increased out-migration), and/or native avoidance (*i.e.* reduced in-migration of natives). Finally, we study the extent to which residential segregation is associated with segregation in terms of educational attainment and labor earnings by exploring if the outmigration rate of natives differs by educational attainment and labor earnings.

In line with previous research, we find that ethnic segregation increased during the 1990s. We also find that non-European immigrants reside more densely concentrated within municipalities than European immigrants. Under the assumption that municipality-specific tipping points exist, we find support for tipping behavior in a majority of the 12 largest municipalities in Sweden. The estimated tipping points are significantly higher for European immigrants than for non-European immigrants. Furthermore, there is no statistically significant difference in the native population growth above and below the tipping point identified for European immigrants whereas the native population growth is considerably lower beyond the identified tipping point related to non-European immigrants. This drop in the growth rate of the native population around the tipping point was between 6 and 7 percent in the 1990s and around 5 percent between 2000 and 2007. We also find that during the 1990s, this drop in the native population growth rate can be attributed to both native flight from areas with an increasing concentration of non-European immigrants and to that natives avoided moving into to such neighborhoods. During the second time period, native flight seems to have been driving the native tipping behavior. Thus, our results indicate that natives are more tolerant to residing in neighborhoods with European than with non-European immigrants but also that natives became somewhat more tolerant to residing in neighborhoods with non-European immigrants over time. Finally, given that out-movers are disproportionally replaced by in-movers of lower status, we find that tipping behavior is likely to be associated with increased socio-economic segregation as natives with high educational attainment and labor earnings are most prone to move out of neighborhoods that have experienced tipping [for research on how selective migration contributes to socio-economic segregation, *see e.g.* Friedrichs 1971; Power 1996; Skifter Andersen 2003]. Although our results cannot be given a causal interpretation, they clearly indicate that native tipping behavior is strongly associated with the segregation of non-European immigrants.

The paper is organized as follows. The Immigrant Population and Ethnic Segregation in Sweden offers an overview of immigration to Sweden since the Second World War and a description of levels and trends in segregation in Sweden from the 1990s and onwards. Theoretical Background provides the theoretical framework and Data presents the data. Empirical Specification presents the empirical models and Results explains the results. Conclusions summarizes and concludes.

THE IMMIGRANT POPULATION AND ETHNIC SEGREGATION IN SWEDEN

Immigrants and the Immigrant Population

Both the size and composition of Sweden's immigrant population have changed during the last decades. In 1940, only about 1 percent of the country's total population had been born abroad. By 1970, this share had risen to 7 percent. As of 2013, about 14 percent of Sweden's population is foreign born. After 1945, and during the 1950s and 1960s, refugees from Eastern Europe moved into Sweden. However, most of the immigration to Sweden from the 1950s until the mid-1970s was labor-force migration resulting from the country's industrial and economic expansion. The labor-force migration consisted primarily of poorly educated immigrants from Finland, former Yugoslavia, Italy, and Greece. During the 1950s and 1960s, labor-force migrants also came from other Nordic countries and from countries in Western Europe such as West Germany.

In the mid-1960s, Swedish trade unions accused immigrants of depressing wages for low-paid workers. A more restrictive immigration policy and the deterioration of the labor market situation changed the character of immigration during the 1970s. As the labor-force migration of European immigrants tapered off, the number of refugees from non-European countries started to increase. In the mid-1970s, refugee migration from Latin America started to reach significant proportions, and during the 1980s, a much larger number of refugees came from Asia and Africa. During the 1990s, refugee migration continued, now dominated by refugees from former Yugoslavia and the Middle East. Refugee migration from countries in the Middle East has continued into the 21st century.

Table 1 shows how the immigrant population has changed. In 1970, about 60 percent of Sweden's foreign-born population had been born in other Nordic countries and about 35 percent in other European countries. Only about 5 percent were born outside Europe. In 2011, less than 20 percent were born in other Nordic countries, about 35 percent were born in other European countries, and almost 47 percent of the immigrant population were born in non-European countries.

Thus, the share of foreign-born immigrants with a non-European background has greatly increased. Further, recently arrived immigrants tend to settle in metropolitan areas such as Stockholm, Gothenburg, and Malmo or in other large municipalities. According to Statistics Sweden (2008), more than 90 percent of the immigrants in the 1997–2002 cohort resided in cities or metropolitan areas 5 years after their immigration.

TABLE 1
THE COMPOSITION OF THE FOREIGN-BORN POPULATION LIVING IN SWEDEN 1960–2011

Region of birth	1960	1970	1980	1990	2000	2008	2011
Nordic countries	58.1	59.7	54.4	40.3	27.9	21.0	18.2
Other European countries	37.0	34.9	33.8	32.1	32.9	35.8	35.3
Non-European countries	4.9	5.4	11.8	27.6	39.2	43.2	46.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Statistics Sweden, *Statistical Yearbook* and *Population Statistics*, different volumes.

Ethnic Segregation in Sweden

The aim of this paper is to examine native residential mobility and its possible contribution to ethnic segregation in Sweden during the 1990s and between 2000 and 2007. The question is, then, to what extent the increased share of immigrants with a European and the increased share of immigrants with a non-European background have lead to increased ethnic segregation in Sweden during that period. The evolution of ethnic segregation in Sweden during the period 1990–2007 is highlighted with the help of calculations of an index of dissimilarity calculated for European and non-European immigrants separately and presented in Table 2. The index of dissimilarity is calculated as:

$$\frac{1}{2}\sum_{i=1}^{N}\left|\frac{i_i}{I}-\frac{n_i}{N}\right|$$

where i_i refers to the immigrant population in the *ith* neighborhood and I refers to the immigrant population in the municipality. Further, n_i is the native population in the *ith* neighborhood, while N is the native population in the municipality. The index score should be interpreted as

TABLE 2
ETHNIC SEGREGATION IN MUNICIPALITIES IN 1990, 2000 AND 2007. EUROPEAN AND NON-EUROPEAN IMMIGRANTS COMPARED TO NATIVES

			Index of dissimilarity					
			European immigrants			Non-European immigrants		
Municipality	Population size(1000)[a]	Number of neighborhoods	1990	2000	2007	1990	2000	2007
Stockholm	1441	849	19.3	18.9	19.8	45.9	47.6	46.8
Uppsala	147	247	20.0	20.0	19.4	55.4	48.6	43.8
Linköping	105	171	16.6	20.9	24.9	41.1	42.2	46.8
Norrköping	99	82	18.7	26.7	26.7	48.0	46.6	43.2
Göteborg	377	774	29.8	33.4	33.4	49.9	52.5	48.8
Jönköping	94	70	20.4	25.3	25.7	52.5	48.5	47.4
Malmö	209	327	28.3	34.0	31.6	47.0	50.5	45.0
Lund	77	107	19.3	19.7	18.1	38.2	36.4	32.0
Helsingborg	96	41	21.3	25.7	26.6	31.2	39.3	37.8
Västerås	93	134	16.0	18.1	18.2	39.8	40.8	41.2
Umeå	81	83	18.3	20.9	17.1	51.6	43.5	41.9
Örebro	104	168	19.6	28.6	29.0	46.9	53.2	52.1
Total[b]			21.6	23.5	23.9	46.7	48.0	46.2

Notes: [a] Average for years 1990, 2000 and 2007.
[b] Average for the twelve municipalities. Weighted by the size of the municipalities' immigrant population.

the percentage of the immigrant group that would have to move to a different neighborhood to produce a distribution equal to that of the native population within the municipality.

The table reveals that ethnic segregation increased in Sweden between 1990 and 2000. Furthermore, the table also reveals that the index of dissimilarity is considerably higher for non-European than for European immigrants indicating that non-European immigrants reside more densely concentrated than European immigrants. The index of dissimilarity increased from 21.6 in 1990 to 23.5 in 2000 for European immigrants and from 46.7 in 1990 to 48.0 in 2000 for non-European immigrants. During the period 2000–2007, segregation among European immigrants continued to increase, while segregation among non-European immigrants decreased. In 2007, index of dissimilarity was 23.9 for European immigrants and 46.2 for non-European immigrants.

To sum up, immigrants from non-European countries reside more densely concentrated than European immigrants. Previous research has documented discrimination against non-European immigrants on the housing market in Sweden. Against this background, we have reason to believe that a large share of non-European immigrants residing in certain neighborhoods also may affect the residential mobility of natives in such neighborhoods.

THEORETICAL BACKGROUND

The concept of neighborhood tipping originated in US research on the residential segregation of the white majority population and the black minority population. Neighborhood tipping was the process in which a neighborhood's composition changed from all-white to all-black. In this process, there was a critical threshold, or tipping point, where the inflow of black residents led to an outflow of white residents, a phenomenon that was termed "white flight" (*e.g.* Goering 1978; Frey 1979; Marshall 1979). Since then, the concept of white avoidance has been used to account for the observation of a reduced in-migration of white residents to neighborhoods with an increased concentration of black residents (*e.g.* Clark 1992; Quillian 2002). Studies on possible explanations to white flight and white avoidance point towards a combination of whites' aversion to having black neighbors and their desire to avoid neighborhoods with characteristics that are associated with African Americans, such as poverty and social problems (*e.g.* Farley et al. 1994; Zubrinsky 2000). In regard to their relative importance, studies on neighborhood preferences show that whites seem to be more sensitive to the ethnic mix in a neighborhood when it comes to moving in to a neighborhood than when moving out (*e.g.* Clark 1991; Farley et al. 1994; Zubrinsky and Bobo 1996).

Social interaction models have been applied to study neighborhood tipping and especially to explain how a majority's preferences for neighborhoods with low minority shares may give rise to residential segregation (Schelling 1971; Becker and Murphy 2000; Card, Mas, and Rothstein 2008b). In these models, the social interaction effect stems from the assumption that people care about the size of the minority share in their neighborhood. It is assumed that the majority population prefers to live in neighborhoods with low minority shares and that the strength of these preferences varies. In the social interaction model introduced by Schelling (1971), there are two groups of people: a majority and a minority. The members of these groups have preferences towards living in an area with a particular share of the members of the other group that varies from very low to very high. Further, there is a neighborhood in which both groups want to live, given that the share of the other group members does not exceed the individual tolerance level. Once an individual's tolerance level is reached, he or she will migrate to a neighborhood that suits his/her preferences. Based on these assumptions, a small change in the neighborhood composition will result in the tolerance level being exceeded for some individuals who will then move out. The new neighborhood composition will in turn induce others to move out, while those who can accept the neighborhood composition will move in. This process will continue until the neighborhood is fully segregated. The main conclusion of the model is that in the presence of social interaction in the majority's preferences, a fully segregated area is likely to be the outcome even when the majority's preferences for a low minority share are weak. Whether the majority or the minority group dominates the area depends on how the process starts; thus tipping can be two-sided. In two-sided tipping models, such as Schelling's, a tipping point is an unstable mixed equilibrium (an integrated neighborhood) bound to be transitioning to one out of two stable equilibria, either an all-majority or an all-minority neighborhood (Card, Mas, and Rothstein 2008a).

Card, Mas, and Rothstein (2008a) formalized a one-sided tipping model in which, unlike the Schelling model, a mixed neighborhood can remain stable as long as its minority share remains below the tipping point.[2] This is made possible by the assumption that there, apart from a social interaction effect, is specificity in the preferences for location choice. Such specificity can, for example, arise because people care about the amenities in the neighborhood, such as local cultural and social institutions, and that these amenities are more important for some individuals than for others. When both neighborhood composition and neighborhood amenities affect an individual's location choice, some individuals are willing to live in a neighborhood, even if they have neighbors from the minority group, because they like the amenities. However, as the minority share in the neighborhood increases, the social interaction effect, that is the preference for neighborhoods with low minority shares, eventually dominates in which case, there is an outflow of majority residents. In this model, the tipping point is the maximum minority share at which a mixed neighborhood can be stable (Card, Mas, and Rothstein 2008a). Thus, a neighborhood can remain mixed as long as the minority share is below the tipping point. Once the minority share exceeds this critical level, the neighborhood tips, there is an outflow of majority residents and the neighborhood moves towards an all-majority neighborhood. The location of the tipping point is to some extent determined by the majority population's tolerance of minority neighbors; the stronger the preferences among the majority against minority neighbors are, the lower the tipping point is expected to be.[3]

Based on the theoretical model by Card, Mas, and Rothstein (2008b), we have good reasons to believe that native residential mobility may have contributed to the residential segregation in Sweden. It has been documented that ethnic discrimination exists on the Swedish housing market and that this discrimination above all is directed towards non-European immigrants (Ahmed and Hammarstedt 2008; Ahmed, Andersson, and Hammarstedt 2010). This suggests that natives care about the ethnic composition in their neighborhood and may have preferences for neighborhoods with a low immigrant concentration, in particular, a low non-European immigrant concentration. Thus, it is likely that an increased immigrant concentration in a neighborhood affects native residential mobility leading to tipping-like behavior.

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[2] The model is based on the social interaction model formalized by Becker and Murphy (2000).

[3] Card, Mas, and Rothstein (2008a) have tested whether tipping is one- or two-sided by studying the residential mobility of Census tracts in metropolitan areas in the US and find evidence of one-sided tipping behavior.

Following Card, Mas, and Rothstein (2008b) we identify tipping points at the municipality level, in other words a common tipping point, m^*, for all neighborhoods within a municipality. This implies that within a municipality, there may be neighborhoods where the immigrant concentration has not yet reached the common tipping point and neighborhoods where the immigrant concentration has reached and passed m^* and, thus, have experienced tipping behavior and a decrease in the native population. Further, it is important to note that preferences for living in neighborhoods with a low immigrant concentration may be attributed to negative attitudes against immigrant neighbors but also indirectly to the possible negative effects that an increased immigrant concentration may have on local amenities, such as reduced quality of local social and cultural institutions (Farley et al. 1994; Andersson 1998; Zubrinsky 2000). Both aspects may result in an increased out-migration or decreased in-migration of natives. Due to differences in labor market attachment, information about job openings and economic resources, immigrants and natives may have different opportunities to leave a certain area. In this study, the purpose is not to isolate these effects but to study the process of tipping behavior and explore how a neighborhood's native population growth is related to the immigrant concentration in the neighborhood.

DATA

We study tipping behavior in the 12 largest Swedish municipalities in 2007: Stockholm, Göteborg, Malmö, Uppsala, Linköping, Västerås, Örebro, Norrköping, Helsingborg, Jönköping, Umeå, and Lund (SCB, Befolkning. Folkmängden efter kommun, civilstånd och kön. År 1968–2010). The municipality of Stockholm is too small to be representative for the city of Stockholm, and therefore we study Stockholm at the county level. We focus on changes in native population growth between 1990 and 2000 and between 2000 and 2007.

To study tipping behavior within these municipalities, we use individual data from the register-based longitudinal data base LISA (Longitudinal Integration Database for Health Insurance and Labour Market Studies) developed by Statistics Sweden. We have information on neighborhood of residence of all individuals living in Sweden, 16 years and older, as well as on their demographic characteristics, labor market characteristics, and use of social benefits in the years 1990, 2000, and 2007.

Neighborhoods are based on SAMS areas (Small Area Market Statistics) created by Statistics Sweden. The SAMS areas are based on classifications made by Swedish municipalities to simplify community planning. The areas were created to obtain small geographical areas that are homogenous in terms of type of housing, household income, and educational attainment *within* the area. The SAMS division is the finest geographical division that can be obtained for Sweden. Although the SAMS units should be constant over time, some smaller adjustments have been made over the years to improve the quality. Because we have access to data on the individuals who live in the SAMS areas, we are able us to explore possible selection in terms of socio-economic characteristics in the outflow of natives from neighborhoods that have tipped.

In total, there are 9,200 SAMS in Sweden with an average of 1,000 inhabitants. In the 12 municipalities included in this study, there are 3,135 SAMS areas in 1990, 3,203 in 2000, and 3,233 in 2007. To obtain neighborhood units that are constant over time, we only include SAMS areas that are present in the data set in 1990, 2000 and in 2007. After these selections, the total number of neighborhoods is 3,053 in 1990, 2000, and in 2007.

We exclude sparsely populated SAMS areas because in these areas even a very small inflow, or outflow, of inhabitants may cause tipping behavior. Therefore, we only include SAMS areas with more than 200 inhabitants. Further, following Card, Mas, and Rothstein (2008a,b), we exclude outliers in terms of neighborhood population growth. Thus, we exclude SAMS areas with (1) a native population growth in each period that is more than five times higher than the base-year total population and (2) a total population growth in each period that is more than five standard deviations higher than the average population growth in the municipality. After these restrictions, the sample used to study tipping behavior comprises 2,276 neighborhoods in 1990–2000 and 2,414 neighborhoods in 2000–2007.

In the empirical analysis, we explore how natives respond to the share of European and non-European immigrants, respectively, residing in their neighborhood. An individual is defined as native if he/she was born in Sweden, whereas an individual is defined as a European (non-European) immigrant if he/she was born in a European (non-European) country.

Table 3 presents descriptive statistics of average changes in the European and non-European immigrant shares over time and the growth in the native population in the neighborhoods included in the sample. It emerges that between 1990 and 2000, the average share of European immigrants in the neighborhoods decreased from about 9 percent to roughly 7 percent, while the share of non-European immigrants rose from roughly 3 percent to 6 percent. The average growth in the native population, on the other hand, decreased from about 5 percent in 1990–2000 to about 3 percent in 2000–2007. There was also a decrease in the average growth in the total population from 9 percent to about 7 percent.

EMPIRICAL SPECIFICATION

Identification of Tipping Points

We follow the method employed by Card, Mas, and Rothstein (2008b) to identify municipality-specific tipping points. The one-sided tipping model predicts that the share of natives should fall discontinuously once the minority share passes some critical value. We apply a method similar to that used for the identification structural breaks in time series analysis to identify this unknown critical value of the European and non-European immigrant shares of the 12 Swedish municipalities at which there is a clear shift in the native population growth.

We estimate a model that relates the mean percentage change in native population of neighborhood *i* in municipality *c* in 1990–2000 and in 2000–2007 to the share of immigrants in the base year of each time period. Let $m^*_{c,t-1}$ denote the municipality-specific tipping point where t–1 is the base year (= 1990, 2000). We test for the candidate tipping points for immigrant shares between 1 and 60 percent. For each candidate

TABLE 3
DESCRIPTIVE STATISTICS OF THE NEIGHBORHOODS INCLUDED IN THE SAMPLE

	European immigrants		Non-European immigrants	
	1990–2000	2000–2007	1990–2000	2000–2007
Mean% immigrants, base year = 1990, 2000	9.4	9.6	3.4	6.0
Growth in total population (%)	8.9	6.5	8.9	6.5
Growth in native population (%)	4.6	3.0	4.6	3.0
Number of SAMS areas	2,276	2,414	2,276	2,414

tipping point, we estimate the following regression model for each municipality, *c*, and for each time period:

$$\mathrm{dn}_{i,c,t} = \alpha_c + d_c 1\left[m_{i,c,t-1} > m^{*}_{c,t-1}\right] + \varepsilon_{i,c,t} \tag{1}$$

The dependent variable, $\mathrm{dn}_{i,c,t}$, is the growth rate of the neighborhoods' native population in each municipality and in each time period. Specifically, $dn_{i,c,t} = \left(N_{i,c,t} - N_{i,c,t-1}\right)/P_{i,c,t-1}$ where $N_{i,c,t}$ is the number of native residents of neighborhood *i* in municipality *c* in the year *t* (=2000, 2007), $N_{i,c,t-1}$ is the number of native residents in the base year *t*–1 (=1990, 2000), and $P_{i,c,t-1}$ is the neighborhood's total population in the base year. $m_{i,c,t-1}$ is the base-year share immigrants of neighborhood *i* in municipality *c*. Specifically, $m_{i,c,t-1} = M_{i,c,t-1} / P_{i,c,t-1}$, where $M_{i,c,t-1}$ is the number of immigrants, respectively, of neighborhood *i* in municipality *c* in the base year. To study whether the natives respond differently to the concentration of European and non-European immigrants in the neighborhood, we estimate equation (1) with $m_{i,c,t-1}$ equal to (1) the share of European immigrant and (2) the share of non-European immigrants. d_c is a dummy variable that equals 1 if the neighborhood immigrant share is larger than the candidate tipping point and 0 otherwise. α_c is a constant term and $\varepsilon_{i,c,t}$ is a random term.

All candidate tipping points between immigrant shares of 1–60 percent are tested, and the tipping point of a municipality is identified by choosing the value of $m^{*}_{c,t-1}$ that yields the highest R^2-value. This value represents the European and non-European immigrant shares at which the municipality experience tipping (*i.e.* where the neighborhood growth in the native population changes discontinuously). Following Card, Mas, and Rothstein (2008b), we use a random subsample of two-thirds of the neighborhoods for each municipality to identify the tipping points. The remaining one-third random subsample is used to quantify the discontinuity.[4] We identify two sets of candidate tipping points for the 12 Swedish municipalities: one set relating to the share of European immigrants and one set relating the share on non-European immigrants.

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[4] The reason for subsampling is that if we use the same data to identify the tipping points and to quantify the discontinuity in the native population growth, we run the risk of rejecting the null hypothesis that there is no discontinuity too often (*see* Leamer 1978).

The Effect of Tipping on Native Population Growth

Next, we explore whether the candidate tipping points described above results in tipping behavior among natives. In other words, we want to investigate whether the native population growth in fact drops significantly once a neighborhood's immigrant concentration has surpassed the municipality-specific tipping point relating to the share of European and non-European immigrants, respectively. For this purpose, we follow Card, Mas, and Rothstein (2008b) and use regression discontinuity methods, which allow us to explore whether the native population growth is statistically significantly smaller in neighborhoods with an immigrant share that is larger than the tipping point than in neighborhoods with smaller immigrant shares. Apart from identifying whether there is a drop in the native population growth, we also estimate the size of the (possible) drop.

In these estimations, we use the one-third random sample of the neighborhoods not used for the identification of the tipping points. From this subsample, we use and pool the neighborhoods of the municipalities with an *identified* candidate tipping point. We estimate the following model:

$$\begin{aligned}\mathrm{dn}_{i,c,t} = \alpha_c + d_c 1\left[m_{i,c,t-1} > m^{*}_{c,t-1}\right] + h\left(m_{i,c,t-1} - m^{*}_{c,t-1}\right)&\\ + \mu_c + \gamma_i + \varepsilon_{i,c,t}&\end{aligned}, \qquad (2)$$

where the dependent variable, $\mathrm{dn}_{i,c,t}$, as before is the neighborhood growth rate of the native population in 1990–2000 and in 2000–2007. The explanatory variable of interest is d_c – that is, a dummy variable equals 1 if the share of immigrants in the base year (= 1990, 2000), $m_{i,c,t-1}$, is larger the identified municipality-specific tipping point, $m^*_{i,c,t-1}$, and 0 otherwise. A negative coefficient on d_c implies that the native population growth is statistically significantly smaller in neighborhoods with an immigrant share that is larger than the value of the tipping point than in neighborhoods with immigrant concentrations that are smaller than the tipping point. To study if natives respond differently to the concentration of European and non-European immigrants in the neighborhood, we estimate equation (2) with $m_{i,c,t-1}$ equal to (1) the share of European immigrant and (2) the share of non-European immigrants. We include a quartic polynomial in the deviation of the immigrant share from the municipality-specific tipping point in order to allow for non-linearity. We also include municipality fixed effects, μ_c, and control variables measured at the neighborhood level, namely unemployment rate and mean individual disposable income. Finally, $\varepsilon_{i,c,t}$ is a random error.

Native Flight and Native Avoidance

The (possible) discontinuous drop in the native population growth at the estimated tipping point can be a result of increased out-migration of natives, referred to as *native flight*, and/or to reduced in-migration of natives to the neighborhood, referred to as *native avoidance*. To explore each of the two explanations, we estimate two models similar to that described by equation (2) above. In the regression model used to study the importance of native flight, the dependent variable is the share of natives in neighborhood i in municipality c in 1990 and 2000, that had moved out by the year 2000 and 2007, respectively:

$$\begin{aligned}\left[(N_{i,c}\,\mathrm{out}_{t,t-1})/P_{i,c,t-1}\right] = {} & \alpha_c + d_c 1\left[m_{i,c,t-1} > m^*_{c,t-1}\right] \\ & + h(m_{i,c,t-1} - m^*_{c,t-1}) + \mu_c + \gamma_i + \varepsilon_{i,c,t}\end{aligned} \tag{3}$$

The (possible) drop in the native population growth can be attributed to native flight, if the estimated coefficient for d_c in equation (3) is positive. This means that the share of natives that had moved out in 1990–2000 and in 2000–2007, respectively, is larger in neighborhoods with an immigrant concentration that is larger than the identified tipping point than in neighborhoods with immigrant concentrations that are smaller than the critical threshold value.

In the regression model used to study native avoidance, the dependent variable is that share of natives in neighborhood i in municipality c that moved in to the neighborhood in 1990–2000 and in 2000–2007, respectively:

$$\begin{aligned}\left[(N_{i,c}\,\mathrm{in}_{t,t-1})/P_{i,c,t-1}\right] = {} & \alpha_c + d_c 1\left[m_{i,c,t-1} > m^*_{c,t-1}\right] \\ & + h(m_{i,c,t-1} - m^*_{c,t-1}) + \mu_c + \gamma_i + \varepsilon_{i,c,t}\end{aligned} \tag{4}$$

If native avoidance is driving the (possible) drop in the native population growth, the estimated coefficient for d_c should be negative. In that case, the share of natives that moved into a specific neighborhood is smaller in neighborhoods with an immigrant share that is larger than the tipping point than in neighborhoods with an immigrant share that is lower than the tipping point.

As in the estimation of equation (2), we include a quartic polynomial, municipality fixed effects, and the unemployment rate and average disposable income at the neighborhood level. As shown in equation (5), the change in the neighborhood's native population growth consists of four parts: out- and in-migration of natives and of people exiting (by death) and entering (by turning 16) the unbalanced panel. If we assume that there is no systematic pattern in how people leave and enter the sample, the estimated effect of tipping on in- and out-migration rates of natives from equations (3) and (4) should add up to the estimated effect of tipping on the native population growth from estimating equation (2).[5]

$$\begin{aligned}\left[(N_{i,c,t}-N_{i,c,t-1})/N_{i,c,t-1}\right] = & \left[N_{i,c}\,\mathrm{in}_{t,t-1}/N_{i,c,t-1}\right] \\ & - \left[N_{i,c}\,\mathrm{out}_{t,t-1}/N_{i,c,t-1}\right] \\ & - \left[N_{i,c}\,\mathrm{exit}_{t,t-1}/N_{i,c,t-1}\right] \\ & + \left[N_{i,c}\,\mathrm{enter}_{t,t-1}/N_{i,c,t-1}\right]\end{aligned} \tag{5}$$

The Effect of Tipping on Socio-Economic Segregation

Finally, we explore the extent to which native tipping behavior is selective in the sense that individuals with a high educational attainment and high labor earnings are more likely to move out from neighborhoods that have tipped than are individuals with a low educational attainment and low labor earnings. For this purpose we use a specification similar to equation (3) to estimate the effect of tipping on native flight for different educational and income groups. We estimate the following model:

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[5] We do not explore whether there are systemic differences in exit rates (mortality rates) from and entry rates to the neighborhoods. Even if such differences exist, they should not affect our results on native flight and native avoidance, as both outmigration and inmigration are conditioned on observing the neighborhood the individual moves from and the neighborhood the individual moves to. However, they can affect our estimate of the effect of tipping on native population growth and may therefore be one reason for why the effects of native flight and native avoidance do not sum up to the estimated change in native population growth in Native Flight and Native Avoidance.

$$\left[(N_{g,i,c}\,\mathrm{out}_{t,t-1})/P_{g,i,c,t-1}\right] = \alpha_c + d_c 1\left[m_{i,c,t-1} > m^*_{c,t-1}\right] + h(m_{i,c,t-1} - m^*_{c,t-1}) + \mu_c + \gamma_i + \varepsilon_{i,c,t}, \tag{6}$$

The dependent variable is calculated as the share of natives in group *g* in neighborhood *i* in municipality *c* in 1990 and 2000, that had moved out from neighborhood *i* by the year 2000 and 2007, respectively. If there is selective out-migration among natives, the estimated coefficients of d_c should be positive and larger in magnitude for natives with a high educational attainment and high labor earnings than for the other educational and income groups. We estimate equation (6) for three educational groups: individuals who have completed (1) primary school, (2) secondary school, and (3) a university degree.[6] Equation 6 is also estimated for four income percentile groups based on the distribution of annual labor earnings: (1) 1st–25th percentile, (2) 26th–50th percentile, (3) 51st–75th percentile, and (4) 76th–100th percentile. Annual labor earnings comprise pre-tax earnings from employment and other types of income that is related to the employment, such as sick leave and parental leave. As labor earnings are likely to differ by gender and with age and since the gender and age composition may differ among neighborhoods, we use annual labor earnings net of age and gender. This is done by first estimating annual labor earnings controlling for age and gender for natives in working age, that is, in the ages 25–64. We then obtain labor earnings net of age and gender by deducting predicted earnings from the earnings observed in the data. Natives are then divided into the income groups defined above on the basis of this earnings measure.

RESULTS

Identification of Candidate Tipping Points

Table 4 shows the results from the estimation of equation (1). Between 1990 and 2000, we can identify a statistically significant and precise candidate tipping point for 9 and 10 of the 12 municipalities in Sweden for

[6] Individuals with missing information about their educational attainment are excluded.

TABLE 4
OVERVIEW OF CANDIDATE TIPPING POINTS

	European immigrants		Non-European immigrants	
	1990–2000	2000–2007	1990–2000	2000–2007
Mean municipality tipping point	9.5	9.8	3.2	4.1
Min municipality tipping point	5.8	3.8	0.3	1.3
Max municipality tipping point	19.3	22.5	8.2	19.0
Number of municipalities with an identified tipping point	9	9	10	9
Number of SAMS areas in the municipalities with an identified tipping point	1,370	1,462	1,444	1,385

European immigrants and non-European immigrants, respectively.[7] For both time periods, that is, in 1990–2000 and 2000–2007, the candidate tipping points identified for the share of European immigrants are larger than the tipping points related to the share of non-European immigrants. This suggests that natives may be more tolerant to residing in areas with European immigrants than in neighborhoods with non-European immigrants. Table 4 further shows that the size of the candidate tipping points increases between the two time periods, especially the tipping points for non-European immigrants. One possible explanation to this pattern is that natives became more tolerant to residing in neighborhoods with non-European immigrants over time.[8]

The Effect of Tipping on Native Population Growth

Next, we explore whether there is tipping behavior among natives, that is, whether there is a negative drop in the native population growth in neighborhoods with an immigrant share larger than the candidate tipping points identified in Identification of Candidate Tipping Points. We also study whether natives respond differently to the share of European immigrants and non-European immigrants, respectively, in their neighborhood. For this purpose, we pool the municipalities with an identified tipping point and estimate a regression discontinuity model using the remaining third of the sample, not used for identification of the tipping points. We

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[7] *See* Tables A1 and A2 in Appendix A for regression results divided by European and non-European immigrants and by municipality and time period.

[8] Research has shown that native attitudes towards immigrants in Sweden have become more positive over the years (*see* Demker 2010).

TABLE 5
REGRESSION DISCONTINUITY MODEL FOR CHANGES IN THE NATIVE POPULATION GROWTH AROUND TIPPING POINT FOR SHARE OF EUROPEAN AND NON-EUROPEAN IMMIGRANTS (ROBUST STANDARD ERRORS CLUSTERED ON THE MUNICIPALITY LEVEL WITHIN PARENTHESES)

	European immigrants		Non-European immigrants	
	(1)	(2)	(3)	(4)
1990–2000				
Beyond tipping point	0.0397	0.0450	−0.0628***	−0.0650***
	(0.0386)	(0.0361)	(0.0180)	(0.0143)
Municipality fixed effects	Y	Y	Y	Y
Polynomial in immigrant share	Quartic	Quartic	Quartic	Quartic
Neighborhood Controls	N	Y	N	Y
Number of observations	686	686	725	725
R^2	0.0925	0.102	0.0970	0.0976
2000–2007				
Beyond tipping point	0.0146	0.0137	−0.0479***	−0.0475***
	(0.0095)	(0.0094)	(0.0133)	(0.0130)
Municipality fixed effects	Y	Y	Y	Y
Polynomial in immigrant share	Quartic	Quartic	Quartic	Quartic
Neighborhood controls	N	Y	N	Y
Number of observations	730	730	690	690
R^2	0.127	0.128	0.151	0.151

Note: Controls at the neighborhood level comprise average disposable income level and unemployment rate. *** indicates statistical significance at 1 percent level, ** at the 5-percent level, and * at the 10 percent level.

estimate two specifications, one without and one with neighborhood controls.[9]

Columns (1) and (2) in Table 5 present the results from estimations relating to the share of European immigrants, where specification in column (1) does not include neighborhood controls, while the specification in column (2) does. For both time periods, the results give no evidence of a drop in the native population growth around the tipping point. The estimated coefficients are positive, indicating a larger native population growth in neighborhoods with a share of European immigrants that was higher than the candidate tipping point than in neighborhoods with lower concentrations of European immigrants, but the effect is not statistically significant. Thus, we find no evidence of native tipping behavior relating to changes in the share European immigrants in the neighborhood.

Turning to how natives respond to changes in the share of non-European immigrants, columns (3) and (4) show a negative and statistically significant effect in both time periods. The effect is robust to the inclusion of neighborhood controls and indicates that there was a drop in the native population growth around the tipping point. For the period 1990–2000, the magnitude of the effect is about 6.5 percent (*see* column [4]), implying that the neighborhoods with a non-European immigrant share that was higher than the value of the municipality tipping point had a native population growth rate that was 6.5 percent lower than the neighborhoods with lower concentrations of non-European immigrants. In 2000–2007, the drop in the native population growth was smaller amounting to 4.8 percent (*see* column [4]).

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[9] We have estimated the regressions varying the degree of the polynomial in the immigrant share between one and four and also by including a polynomial in the neighborhood control variables up to level four. The results were not affected by this.

Native Flight and Native Avoidance

In the above section, we found that natives appear to respond to changes in the share of non-European immigrants in their neighborhood, but not to the concentration of European immigrants. Therefore, in this section, we focus on natives' response to changes in the share of non-European immigrants and explore the extent to which the observed drop in the native population growth at the tipping point identified in the section above can be attributed to an increased out-migration of natives, "native flight" and/or an decreased in-migration of natives, "native avoidance". We estimate two specifications, one without and one with neighborhood controls.[10]

For time period 1990–2000, Table 6 reveals that the native tipping behavior relating to the share of non-European immigrants appears to have been driven both by native flight and native avoidance. Columns (1) and (2) show the effect of tipping on the outmigration of natives and in the first time period, the effect is positive and statistically significant but decreases somewhat when neighborhood controls are included. Based on the result in column (2), the effect amounts to 3.3 percent, implying that neighborhoods with a non-European immigrant share larger than the municipality-specific tipping point had, on average, a 3.3 percent higher outflow of natives compared with the neighborhoods with a lower concentration of non-European immigrants.

[10] The model has been tested with the degree of the polynomial in the immigrant share varying between one and four and also by including a polynomial in the neighborhood control variables up to level four. Altering the specification in this way had no effect on the results.

TABLE 6
REGRESSION DISCONTINUITY MODEL OF NATIVE FLIGHT AND NATIVE AVOIDANCE AROUND TIPPING POINT FOR SHARE OF NON-EUROPEAN IMMIGRANTS (ROBUST STANDARD ERRORS CLUSTERED ON THE MUNICIPALITY LEVEL WITHIN PARENTHESES)

	Native flight (1)	Native flight (2)	Native avoidance (3)	Native avoidance (4)
1990–2000				
Beyond tipping point	0.0428***	0.0326**	−0.0171	−0.0220*
	(0.0115)	(0.0128)	(0.0137)	(0.0105)
Municipality fixed effects	Y	Y	Y	Y
Polynomial in the immigrant share	Quartic	Quartic	Quartic	Quartic
Neighborhood controls	N	Y	N	Y
Number of observations	725	725	725	725
R^2	0.315	0.328	0.176	0.177
2000–2007				
Beyond tipping point	0.0464***	0.0439***	0.0238	0.0233
	(0.0071)	(0.0075)	(0.0167)	(0.0162)
Municipality fixed effects	Y	Y	Y	Y
Polynomial in immigrant share	Quartic	Quartic	Quartic	Quartic
Neighborhood controls	N	Y	N	Y
Number of observations	690	690	690	690
R^2	0.295	0.308	0.156	0.160

Note: Controls at the neighborhood level comprise average disposable income level and unemployment rate. *** indicates statistical significance at 1 percent level, ** at the 5-percent level, and * at the 10 percent level.

Turning to columns (3) and (4) in Table 6, which shows the results when the dependent variable is the share of natives moving in to a neighborhood, the effect of tipping on the propensity to move is negative but statistically insignificant in column (3). However, when we include neighborhood controls in column (4), the effect increases somewhat to 2.2 percent and becomes statistically significant. Thus, in 1990–2000, the in-migration rate of the natives was, on average, 2.2 percent lower in neighborhoods with a non-European immigrant share higher than the tipping point value than in neighborhoods with lower concentrations. Note that the effects of tipping on native flight and native avoidance nearly sum up to the drop in the native population growth of 6.5 percent found in Table 5 (*see* column [4]). The reason for not summing up exactly may be due systematic differences in exits from the sample by death and entry reaching the age threshold 16 across the neighborhoods.

In 2000–2007, the estimated effect of tipping for native flight is positive and statistically significant, whereas the estimated effect of tipping for native avoidance is not statistically significant. In column (2), the effect for native flight amounts to 4.4 percent, indicating that the outmigration rate of the natives was, on average, 4.4 percent higher in neighborhoods with an immigrant share exceeding the tipping point than in neighborhoods with smaller non-European immigrant shares. Comparing this effect to the estimated drop in the native population growth of 4.8 percent in Table 5 (*see* column [4]), suggests that natives leaving neighborhoods with a high concentration of non-European immigrants was the main driving force of the native tipping behavior in 2000–2007. In contrast to the 1990s, there is no evidence of natives avoiding moving in to such neighborhoods.

Sensitivity Checks

We have conducted sensitivity checks to check the robustness of the results. Different dimensions of robustness have been checked. First, one may argue that the tipping point may differ within large metropolitan areas such as Stockholm. In our previous estimations, we included the entire county of Stockholm. In our sensitivity checks, the county of Stockholm was divided into four subareas, which were homogeneous within each subarea with respect to residents' average disposable income. The results from these estimations, in all essential, turned out to be the same as the results previously presented. All results and all definitions are available from the authors upon request.

In a second step, we ran all estimations presented above for SAMS areas with more than 400 inhabitants, to check for how sensitive the results are to neighborhood size. The results relating to the effect of tipping on the native population growth are in line with the results presented above. Further, the finding that the drop in the native population growth around the tipping point was driven by native flight both in 1990–2000 and in 2000–2007 is also robust to changes in the neighborhood size; the estimated effect is positive, and its magnitude remain fairly constant. However, the effect for native avoidance found in 1990–2000 is no longer statistically significant. The robustness of the results for native flight combined with the fact that the magnitude of the effect for native flight is larger than that of native avoidance for the time period 1990–2000 (*see* Table 6, columns [2] and [4]), suggest that native flight appears to have been the main driving force to the drop in the native population growth observed both in 1990–2000 and in 2000–2007. The results from these estimations are available from the authors upon request.

The Effect of Tipping on Socio-Economic Segregation

The results in section The Effect of Tipping on Native Population Growth and Native Flight and Native Avoidance point at the existence of native tipping behavior relating to changes in the concentration of non-European immigrant both in 1990–2000 and in 2000–2007 and that this behavior was driven mainly by native flight. In this section, we explore the extent to which native tipping behavior, apart from residential segregation, may be associated with socio-economic segregation in terms of educational attainment and labor earnings.

Table 7 shows descriptive statistics of annual labor earnings and educational attainment for native movers and stayers residing in neighborhoods with a non-European immigrant share larger than the identified tipping point, in 1990–2000 and 2000–2007, respectively. For both time periods, natives who moved from neighborhoods that had tipped had, on average, a higher educational attainment than natives who did not move. For example, in 1990–2000, the share with a university degree was 9 percent higher among the movers than among the stayers, and the corresponding share was 16 percent higher in 2000–2007. Further, Table 7 reveals that in both time periods, natives who moved had slightly higher annual labor earnings than natives that did not move. Thus, Table 7 suggests that natives who moved from neighborhoods that had tipped were positive selected in terms of educational attainment and labor earnings.

TABLE 7

Educational Attainment and Annual Labor Earnings of Native Stayers and Movers Residing in Neighborhoods that have Experienced Tipping

	Period 1990–2000			Period 2000–2007		
Variable	Movers	Stayers	Movers / Stayers	Movers	Stayers	Movers / Stayers
Educational attainment						
Primary school	20.5	25.8	0.79	10.8	15.6	0.69
Secondary school	45.4	43.0	1.05	42.5	44.1	0.96
University degree	34.1	31.2	1.09	46.7	40.3	1.16
Annual labor earnings in the first year of the period	153,000	152,000	1.01	221,000	213,000	1.04
Number of observations	334,253	632,852		363,901	880,408	

Note: The descriptive statistics for annual labor earnings are restricted to individuals age 25–64 (in working age). Annual labor earnings are measured in 1990 for the period 1990–2000 and in 2000 for the period 2000–2007.

To explore this further, we study the extent to which the native flight behavior differs among natives with different levels educational attainment and annual labor earnings. The results from the estimation of equation (7) are presented in Table 8.

Columns (1) – (4) show the results for natives with different levels of educational attainment. Column (1) presents the pooled result for all educational groups and in both time periods, the estimated effect similar to those found in the estimations for native flight in Table 6. Further, both in 1990–2000 and in 2000–2007, Table 8 suggests that the outflow of natives from neighborhoods that had tipped was highest among natives with a relatively high educational attainment. In 1990–2000, the effect of tipping on native flight amounted to 4.4 and 5.8 percent for natives with secondary schooling and with a university degree, respectively. Thus, among natives with a university degree, neighborhoods with a non-European immigrant share above the municipality specific tipping point had, on average, a 5.8 percent higher outflow of natives compared to the neighborhoods with a lower concentration of non-European immigrants. In 2000–2007, the corresponding effects are 5.8 percent for natives with secondary schooling and 7.8 percent for natives with a university degree. In both time periods, among natives with primary schooling, there is no statistically significant difference in the outflow of natives between neighborhoods that have tipped and neighborhoods with immigrant concentrations smaller than the tipping point.[11]

Table 8 also shows the results from the estimation of native flight for the different income percentile groups. Column (5) shows the pooled results including all income percentile groups, which again are comparable to the results found in Table 6. Columns (6) – (9) present the results for each income percentile group. In the first period, 1990–2000, the effect of tipping on the outmigration among natives in the top of the earnings distribution, that is, among the 25 percent with the highest labor earnings, was about 6.3 percent compared with about 3 percent for natives

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[11] t-tests show that in 1990–2000, the differences in the effects of tipping on native flight among natives with different educational attainment are not statistically significant. However, in 2000–2007, the effect for natives with a university degree education group is statically significantly higher than the effects for natives with primary and secondary schooling. In addition, the effect for natives with secondary schooling is statistically significantly higher for than that for natives with primary. The t-tests are available from the authors on request.

TABLE 8

Regression Discontinuity Model for Native Flight for Different Levels of Educational Attainment and Annual Labor Earnings (Robust Standard Errors Clustered on the Municipality Level Within Parentheses)

	All education groups (1)	Primary School (2)	Secondary School (3)	University degree (4)	All income groups (5)	Percentile <26th (6)	Percentile 26th–50th (7)	Percentile 51th–75th (8)	Percentile >75th (9)
1990–2000									
Beyond tipping point	0.0421***	0.0244	0.0438***	0.0581***	0.0423***	0.0385***	0.0328**	0.0250*	0.0628***
	(0.0107)	(0.0190)	(0.0117)	(0.0137)	(0.0092)	(0.0112)	(0.0112)	(0.0119)	(0.0135)
Municipality fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Polynomial in the immigrant share	Quartic	Quartic	Quartic	Quartic	Quartic	Quartic	Quartic	Quartic	Quartic
Neighborhood controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number of observations	2175	725	725	725	2900	725	725	725	725
R^2	0.258	0.302	0.289	0.286	0.251	0.341	0.387	0.390	0.270
2000–2007									
Beyond tipping point	0.0489***	0.0103	0.0588***	0.0775***	0.0600***	0.0407***	0.0575***	0.0607***	0.0778***
	(0.0062)	(0.0098)	(0.0100)	(0.0110)	(0.0085)	(0.0085)	(0.0119)	(0.0130)	(0.0112)
Municipality fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Polynomial in immigrant share	Quartic	Quartic	Quartic	Quartic	Quartic	Quartic	Quartic	Quartic	Quartic
Neighborhood controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number of observations	2070	690	690	690	2760	690	690	690	690
R^2	0.212	0.304	0.316	0.245	0.138	0.249	0.307	0.311	0.337

Note: Controls at the neighborhood level comprise average disposable income level and unemployment rate. *** indicates statistical significance at the 1 percent level, ** at the 5-percent level, and * at the 10 percent level.

with relatively lower earnings, suggesting that in 1990–2000, high-income earners were more likely than natives with lower labor earnings to move out of neighborhoods that had tipped.[12] We observe a similar pattern in 2000–2007; the effect of tipping on native flight for the different income groups increases as we move up the earnings distribution from about 4 percent for natives with the lowest earnings to about 8 percent for natives with the highest earnings.[13]

To sum up, Table 8 shows that, given that native out-movers are disproportionally replaced by in-movers of lower status, native tipping behavior may be associated with increased socio-economic segregation both in terms of educational attainment and labor earnings, as the outmigration rate of individuals with a high educational attainment and high labor earnings from neighborhoods that have tipped, appears to be higher than for natives with a low educational attainment and low labor earnings.[14]

CONCLUSIONS

This paper has studied how natives' residential mobility is associated with ethnic geographical segregation using Swedish individual level data for the years 1990–2007. Specifically, we have examined the existence of native tipping behavior related to the concentration of European and non-European immigrants and, in contrast to previous research, we have been able to examine whether tipping behavior can be attributed to native flight and/or native avoidance and the extent to which tipping behavior may be associated with increased socio-economic segregation.

We find that geographical ethnic segregation increased during the 1990s and remained fairly constant between 2000 and 2007. We also find that non-European immigrants reside more densely concentrated within municipalities than European immigrants. Such segregation may have implications for labor market outcomes, welfare dependency, as well as school achievement in Sweden's immigrant population.

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[12] t-tests show that the difference between natives with the highest and the lowest earnings is statistically significant. The differences in the estimated coefficients among the other income groups are not statistically significant.

[13] t-tests show that the coefficient for "beyond tipping point" is statistically significantly higher in all income groups in comparison to the lowest (<26th) percentile group. Between the other groups, there are no statistically significant differences.

[14] We have also estimated the effect of tipping on native population growth for the different educational and earnings percentile groups. In all essentials, these results point in the same direction as the results presented in Table 8. The results from these estimations are available from upon request.

As in previous research using US data, we find support for tipping behavior among natives in a majority of Sweden's 12 largest municipalities. However, the estimated tipping points are significantly higher for European immigrants than for non-European immigrants. In addition, we find no statistically significant difference in the native population growth between neighborhoods with a European immigrant share that is larger than the tipping point and neighborhoods with lower concentrations of European immigrants. In contrast, when we turn to how natives respond to the concentration of non-European immigrants, we find that the native population growth is considerably smaller in neighborhoods that have tipped, although the difference in growth rates decreases somewhat between 1990–2000 and 2000–2007.

A possible explanation to the different responses of natives to the concentration of European and non-European immigrants in their neighborhood may be that natives are more tolerant towards residing in neighborhoods with a relatively high concentration of European immigrants compared to residing in neighborhoods with a large share of non-European immigrants. This is in line with previous research that shows that non-European immigrants are discriminated against both on the labor and housing market and that European immigrants are better attached to the Swedish labor market (Hammarstedt 2003; Carlsson and Rooth 2007; Hammarstedt and Shukur 2007; Ahmed and Hammarstedt 2008; Ahmed, Andersson, and Hammarstedt 2010). This finding suggests that it is the characteristics of immigrants that matters for native tipping behavior rather than immigrant status or immigration *per se*. However, even if natives are less tolerant towards having non-European immigrant neighbors, the fact that we find smaller tipping points relating to the concentration of non-European immigrants as well as a smaller drop in the native population growth in 2000–2007 compared with the 1990s, suggest that natives have become more tolerant over time towards living in neighborhoods with relatively high concentrations of non-European immigrants. It is important to note that natives' preferences for living in neighborhoods with a concentration of non-European immigrants may be a result of natives having negative attitudes towards having non-European immigrant neighbors but also of the possible negative effects that an increased immigrant concentration may have on local amenities, such as schools and other social institutions. In this paper, we are not able to isolate these two effects.

The access to individual data has enabled us to examine the mechanisms behind the native tipping behavior relating to the concentration of non-European immigrants. First, our results show that both in 1990–2000 and 2000–2007, the drop in the native population growth in neighborhoods that have tipped, appears to be driven mainly by native flight, that is, an increased outmigration of natives, although there is some evidence of native avoidance in the 1990s. Secondly, we also explored the extent to which tipping behavior among natives, apart from ethnic segregation, may be associated with socioeconomic segregation. We find that natives with high educational attainment and high labor earnings are more likely to leave neighborhoods that have tipped than are natives with low educational attainment and low labor earnings. Given that native outmovers are disproportionately replaced in-movers of lower socio-economic status, this suggests that native tipping behavior is also likely to be associated with increased socio-economic segregation in terms of educational attainment and labor earnings.

Finally, the existence and implications of ethnic geographical segregation are often debated among both policymakers and among researchers. So are the existence of ethnic enclaves and their advantages and disadvantages. There is also an ongoing debate on the extent to which ethnic segregation is self-chosen or driven by ethnic discrimination on the housing market. This paper has shed new light on the mechanisms and driving forces behind ethnic geographical segregation and the creation of ethnic enclaves. Even if ethnic segregation is self-chosen in the sense that immigrants prefer to reside near other immigrants from their own country of origin, this segregation is reinforced by the fact that it also affects the residential mobility behavior of natives. Even though our results cannot be given a causal interpretation, they clearly show that natives tend to move out of areas with a high concentration of non-European immigrants, suggesting that native residential mobility behavior is one of the driving forces behind the existence of ethnic geographical segregation.

APPENDIX A

TABLE A1

Identification of Municipality Tipping Points and Results from Regression Discontinuity Model for Population Changes around the Tipping Point for Share of European Immigrants (Robust Standard Errors Within Parentheses)[A]

	Native population growth					
	Stockholm 1990–2000	Stockholm 2000–2007	Göteborg 1990–2000	Göteborg 2000–2007	Malmö 1990–2000	Malmö 2000–2007
Beyond tipping point	−0.0869*** (0.0277)	−0.0536*** (0.0195)	−0.127*** (0.0321)	−0.0528*** (0.0174)	−0.152*** (0.0265)	−0.0307* (0.0167)
Number of observations	450	498	370	410	139	152
R^2	0.021	0.015	0.041	0.022	0.194	0.022
Tipping point%	0.06	0.14	0.17	0.22	0.19	0.09

	Uppsala 1990–2000	Uppsala 2000–2007	Linköping 1990–2000	Linköping 2000–2007	Västerås 1990–2000	Västerås 2000–2007
Beyond tipping point	−0.0594** (0.0263)	−0.0652*** (0.0221)	0.381* (0.205)	−0.0889 (0.111)	−0.149*** (0.0461)	−0.0669** (0.0253)
Number of observations	100	115	61	75	70	69
R^2	0.050	0.071	0.055	0.009	0.134	0.094
Tipping point%	0.07	0.09	0.06	0.09	0.07	0.09

	Örebro 1990–2000	Örebro 2000–2007	Norrköping 1990–2000	Norrköping 2000–2007	Helsingborg 1990–2000	Helsingborg 2000–2007
Beyond tipping point	−0.189*** (0.0471)	−0.0703** (0.0266)	−0.139*** (0.0422)	−0.0555*** (0.0202)	−0.0763*** (0.0227)	−0.0439 (0.0263)
Number of observations	73	79	51	52	27	25
R^2	0.185	0.083	0.182	0.131	0.311	0.108
Tipping point%	0.06	0.04	0.09	0.07	0.08	0.10

	Jönköping 1990–2000	Jönköping 2000–2007	Umeå 1990–2000	Umeå 2000–2007	Lund 1990–2000	Lund 2000–2007
Beyond tipping point	−0.107** (0.0484)	−0.0694** (0.0276)	0.307** (0.133)	−0.0278 (0.0542)	0.145* (0.0848)	−0.0403** (0.0196)
Number of observations	42	41	43	44	40	41

TABLE A1 (CONTINUED)

IDENTIFICATION OF MUNICIPALITY TIPPING POINTS AND RESULTS FROM REGRESSION DISCONTINUITY MODEL FOR POPULATION CHANGES AROUND THE TIPPING POINT FOR SHARE OF EUROPEAN IMMIGRANTS (ROBUST STANDARD ERRORS WITHIN PARENTHESES)[a]

	Jönköping 1990–2000	Jönköping 2000–2007	Umeå 1990–2000	Umeå 2000–2007	Lund 1990–2000	Lund 2000–2007
R^2	0.110	0.140	0.116	0.006	0.072	0.098
Tipping point%	0.07	0.10	0.09	0.03	0.03	0.05

Notes: *** indicates statistical significance at 1 percent level, ** at the 5-percent level, and * at the 10 percent level.

[a] We have excluded obvious outliers in order to obtain tipping points that are not driven by a few observations. By calculating how much an observation influences the regression model as a whole (*i.e.* how much the predicted values change as a result of including and excluding a particular observation), SAMS areas with a |DfFIT| > 2*SQRT *(k/N)* were excluded. *k* is the number of parameters (including the intercept) and *N* is the sample size.

TABLE A2

IDENTIFICATION OF MUNICIPALITY TIPPING POINTS AND RESULTS FROM REGRESSION DISCONTINUITY MODEL FOR POPULATION CHANGES AROUND THE TIPPING POINT FOR SHARE OF NON-EUROPEAN IMMIGRANTS(ROBUST STANDARD ERRORS WITHIN PARENTHESES)[A]

	Native population growth					
	Stockholm 1990–2000	Stockholm 2000–2007	Göteborg 1990–2000	Göteborg 2000–2007	Malmö 1990–2000	Malmö 2000–2007
Beyond tipping point	−0.117*** (0.0148)	−0.0941*** (0.0152)	−0.0874*** (0.0335)	−0.0383*** (0.0113)	−0.0853*** (0.0222)	0.0390** (0.0195)
Number of observations	448	498	363	410	147	152
R^2	0.122	0.072	0.018	0.027	0.092	0.026
Tipping point%	0.01	0.03	0.08	0.02	0.03	0.10
	Uppsala 1990–2000	Uppsala 2000–2007	Linköping 1990–2000	Linköping 2000–2007	Västerås 1990–2000	Västerås 2000–2007
Beyond tipping point	−0.0986** (0.0409)	−0.0621*** (0.0153)	−0.379** (0.148)	−0.0821*** (0.0278)	−0.0985*** (0.0333)	−0.0786*** (0.0250)
Number of observations	98	115	57	75	70	69
R^2	0.057	0.128	0.106	0.107	0.114	0.128
Tipping point%	0.003	0.03	0.06	0.03	0.01	0.02
	Örebro 1990–2000	Örebro 2000–2007	Norrköping 1990–2000	Norrköping 2000–2007	Helsingborg 1990–2000	Helsingborg 2000–2007
Beyond tipping point	−0.150*** (0.0339)	−0.0643** (0.0266)	−0.108*** (0.0258)	−0.140*** (0.0410)	−0.0418 (0.0393)	−0.0359 (0.0278)

TABLE A2 (CONTINUED)
IDENTIFICATION OF MUNICIPALITY TIPPING POINTS AND RESULTS FROM REGRESSION DISCONTINUITY MODEL FOR POPULATION CHANGES AROUND THE TIPPING POINT FOR SHARE OF NON-EUROPEAN IMMIGRANTS(ROBUST STANDARD ERRORS WITHIN PARENTHESES)A

	Örebro 1990–2000	Örebro 2000–2007	Norrköping 1990–2000	Norrköping 2000–2007	Helsingborg 1990–2000	Helsingborg 2000–2007
Number of observations	73	79	48	52	28	24
R^2	0.215	0.070	0.277	0.188	0.042	0.070
Tipping point%	0.03	0.01	0.03	0.19	0.02	0.02

	Jönköping 1990–2000	Jönköping 2000–2007	Umeå 1990–2000	Umeå 2000–2007	Lund 1990–2000	Lund 2000–2007
Beyond tipping point	−0.104*** (0.0381)	−0.0775*** (0.0250)	0.307** (0.133)	−0.0713** (0.0347)	−0.0962* (0.0503)	−0.0305 (0.0204)
Number of observations	42	43	43	44	39	43
R^2	0.156	0.190	0.116	0.091	0.090	0.052
Tipping point%	0.01	0.02	0.14	0.02	0.06	0.02

Notes: ***indicates statistical significance at 1 percent level, ** at the 5-percent level, and * at the 10 percent level.
[a]We have excluded obvious outliers in order to obtain tipping points that are not driven by a few observations. By calculating how much an observation influences the regression model as a whole (*i.e.* how much the predicted values change as a result of including and excluding a particular observation), SAMS areas with a |DfFIT| > *2**SQRT *(k/N)* were excluded. *k* is the number of parameters (including the intercept) and *N* is the sample size.

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